

Review of the genus *Guaranidrilus* (Oligochaeta, Enchytraeidae) with the description of two new species

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Synopsis

Guaranidrilus Černosvitov, 1937 was erected to contain three new species from Argentina, *G. glandulosus*, *G. rarus* and *G. fridericoides* nom. nud. and a species of doubtful affinity, *G. (Henlea) columbianus* from Columbia. Only one other species, *G. lamottei* from Africa, has since been described. Although *G. fridericoides* was never described, re-examination of Černosvitov's specimens reveals that the species is distinctive. The genus is emended and two new species are described: *G. cernosvitovi* sp. nov. (for *G. fridericoides* nom. nud.) and *G. europeus* sp. nov. from France and Spain.

Introduction

The genus *Guaranidrilus* was erected by Černosvitov (1937a) to include four species: *G. glandulosus*, *G. rarus* and *G. fridericoides*, new species from Argentina; and *G. columbianus* (Michaelson, 1913) from Columbia. The new species were not described at the time but subsequently descriptions were provided for two, *G. glandulosus* and *G. rarus*, together with a redefinition of the genus (Černosvitov, 1937b). The third, *G. fridericoides*, has never been described so the name does not fulfil the requirements of Article 13a of the International Code of Zoological Nomenclature and is considered to be a *nomen nudum*. Only one other species has been recorded, *G. lamottei* Omodeo, from the Ivory Coast (Omodeo, 1958). Recently new material of *Guaranidrilus* was collected from France and Spain and led to an investigation of the genus. Re-examination of Černosvitov's material of *G. fridericoides* in the British Museum (Natural History) showed that the species is distinct and a description is given in this paper together with details of a new species from S.W. France and the Pyrenees.

The three previously recorded localities of *Guaranidrilus* lie between 8° N and 27° S, thus the genus appears to have a mainly tropical distribution. Černosvitov (1937b) expressed the opinion that the genus is probably widely distributed in both tropical and subtropical parts of South America, although he presented no evidence to support this view. The discovery of a new species in south-west France and the Pyrenees is of special interest because it extends the known geographical range of *Guaranidrilus*. This new European species displays the essential characteristics of the genus but departs in two respects from Černosvitov's diagnosis: a seminal vesicle is absent and there are no oesophageal glands. Similarly *G. lamottei* also exhibits characters not shared with Černosvitov's species. The inclusion of these Old World species makes it necessary to emend the genus.

GUARANIDRILUS Černosvitov, 1937 (emended)

TYPE SPECIES. *G. glandulosus* Černosvitov, 1937 (designated by Brinkhurst & Jamieson, 1971).

DIAGNOSIS. Setae straight, without nodulus, two per bundle. Head pore at the tip of the prostomium; dorsal pores absent. Three pairs of septal glands united dorsally, all with ventral lobes. Sudden transition between oesophagus and intestine with a pair of bilobed intestinal diverticula at the oesophago-intestinal transition. Dorsal vessel originating in the clitellar region

or just anterior to it. Interstitial tissue of the nephridia well developed; anteseptale large, containing coils of the canal, efferent duct terminal. Sperm funnel cylindrical, duct long and thin and wound into a spiral. Penial bulb compact. Spermatheca simple, not communicating with the oesophagus.

HABITAT. Terrestrial and freshwater.

SPECIES. *G. glandulosus*, *G. cernosvitovi* sp. nov. and *G. europeus* sp. nov. are distinctive species which cannot be confused with any of the enchytraeid species presently known and which fall clearly within the genus as defined. *G. columbianus* and *G. lamottei* are both incompletely described, there is therefore some doubt concerning their taxonomic affinities. *G. rarus* is close to *G. glandulosus* and the validity of the species is doubtful.

REMARKS. The intestinal diverticula have a characteristic bilobed shape which may be unique among the Enchytraeidae. Although diverticula occur at the oesophago-intestinal transition in *Buchholzia*, *Enchytronia* and some species of *Henlea*, these taxa differ from *Guaranidrilus* in possessing spermathecae which communicate with the oesophagus. Two characters which Černosvitov regarded as having generic significance have been omitted from the emended diagnosis: the presence of oesophageal glands (which he termed 'peptonephridia') and the presence of a seminal vesicle. Paired, spherical, oesophageal glands are present in VI in all three Argentinian species but in *G. lamottei* they originate at IV/V and are long and forwardly directed. Glands attached to the anterior part of the oesophagus have not been reported in *G. columbianus* and are probably absent as in *G. europeus*. This is seemingly a variable character as in *Marionina* and *Achaeta*. The seminal vesicle is variable in many enchytraeid genera. In *Fridericia*, for example, it is present in most species with large individuals but is absent from many of the species in which the worms are smaller.

SPECIFIC CHARACTERS. The main characters of the species are listed in Table 1. The most useful diagnostic characters are the presence and form of the oesophageal glands, the position of the intestinal diverticula, the size of the sperm funnel and seminal vesicle and the shape and size of the spermatheca. Černosvitov probably did not have access to live material and for this reason may have overemphasized the taxonomic importance of the position of the intestinal swelling and the shape and size of the intestinal diverticula. Examination of living specimens of *G. europeus* reveals that the intestinal diverticula are contractile and can vary in shape and size in an individual (Fig. 3). Also, the intestinal swelling appears to alter position according to the state of the diverticula, e.g. when the latter are expanded, the swollen region of the gut is pushed posteriorly. These characters are therefore unreliable for purposes of identification.

Guaranidrilus glandulosus Černosvitov, 1937

Guaranidrilus glandulosus Černosvitov, 1937b : 149, figs 1-9.

TYPE MATERIAL. Syntypes: 5 microslides (1 whole mount and 4 vertical longitudinal sections), British Museum (Natural History) Reg. Nos 1949.3.1.949-954. Collected 17.xi.31 and 18.ix.31; collector unknown.

Černosvitov stated that specimens were deposited in the Museo Argentino de Ciencias Naturales. The material referred to is probably that which is now in the collections of the British Museum (Natural History) (see *G. rarus*).

TYPE LOCALITY. Loreto, near Santa Ana, Misiones, Argentina. Soil rich in humus and stream detritus.

REMARKS. While Černosvitov's description is adequate, he gives no indication of the number of specimens examined or the extent of variation observed. The surviving material is, for the most part, poor, only one of the preparations shows the diagnostic characters clearly. It seems probable that the description was based on a small number of specimens giving a somewhat narrow concept of the species. Some variation is to be expected, especially in the size of the intestinal diverticula.

Table 1 The species of *Guaranidrillus*: distinguishing characters

	<i>G. glandulosus</i>	<i>G. cernosvitovi</i> sp. nov.	<i>G. europaeus</i> sp. nov.	<i>G. columbianus</i>	<i>G. lamottei</i>	<i>G. rarus</i>
Size (in mm)	5-7	12-13	2-4	4.5-6.5	c. 10	2.5-3
Segments	30-35	47-48	23-29	35-40	57-58	33
Setae, presence (2 per bundle)	throughout	throughout	throughout	throughout	dorsal bundles absent from VIII	throughout
Cutaneous glands	distinct, 6-8 rows	indistinct	indistinct, 4-5 rows	indistinct	?	absent
Clitellar glands, arrangement	regular rows	regular rows	regular rows	regular rows	?	regular rows
Head pore, location	tip of O	tip of O	tip of O	tip of O	O/I	tip of O
Oesophago-intestinal transition	mid VIII	VII/VIII	VII/VIII	IX/X?	VII/VIII	Post part of VII
Intestinal diverticula communicating in occupying	VIII	VII	VII/VIII	VII/VIII	VII/VIII	VII
Oesophageal glands	VII, VIII, IX dorsal in VI	VII, VIII dorso-lateral in VI	VII, VIII absent	VII, VIII (IX) absent	VII	VII
Origin of dorsal vessel	XII/XIII	X/XI	XII/XIII	X	originating in IV, long, directed ant.	ventral in VI
Brain	cleft	cleft	cleft	cleft	XI/XII	XI/XII
length : width	1.5	?	2	1.5	nearly straight	cleft
Sperm funnel					1.5	?
length : width						
Seminal vesicle	1.5	4-5	1.5	2	?	1.5
Spermatheca :	medium size	very large	absent	absent	?	medium size
ampulla	free, in VII	free, in VII-IX	free, in VI	communicating ?	free (immature)	free, in VI
duct	thin-walled, ectal swelling	thick-walled, no ectal swelling	thin-walled, slight swelling	ectal swelling ?	?	thin-walled, no distinct swelling
ectal glands	absent	absent	absent	small	?	absent

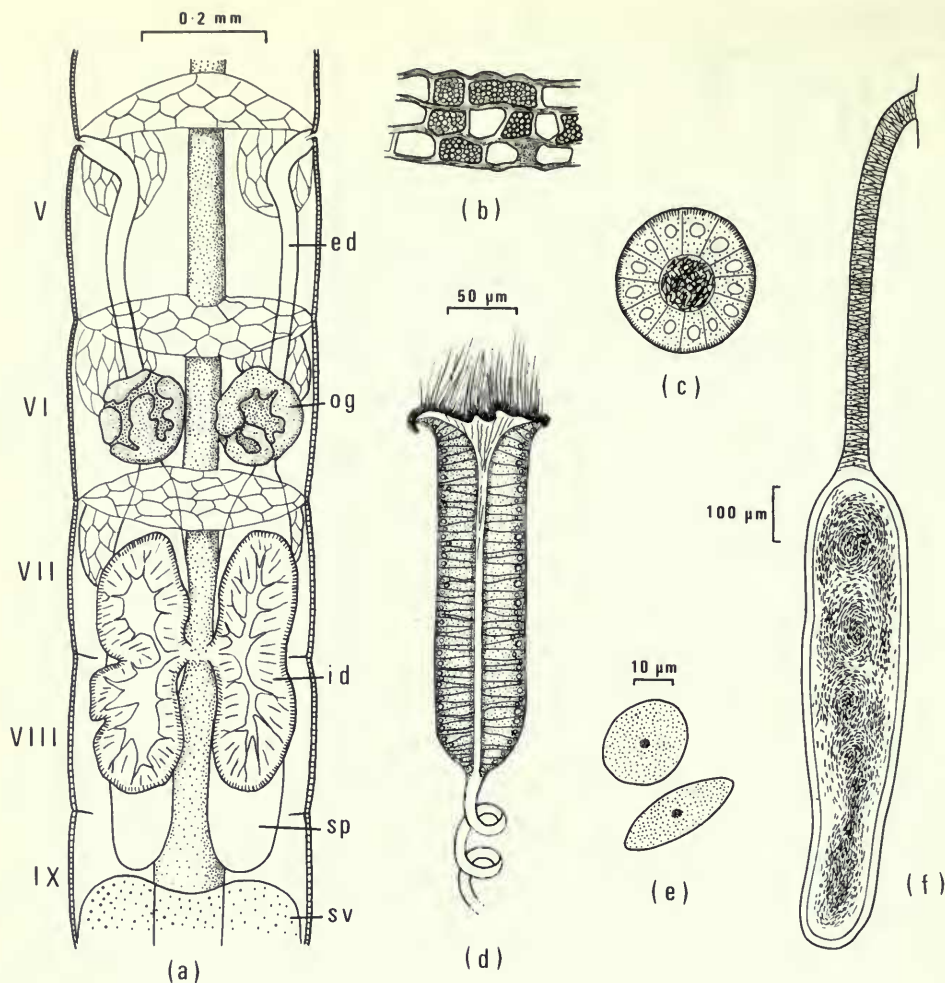


Fig. 1 *Guaranidrilus cernosvitovi* sp. nov.: (a) Segments V-IX. *ed* - ectal duct of spermatheca, *og* - oesophageal gland, *id* - intestinal diverticulum, *sp* - spermathecal ampulla, *sv* - seminal vesicle; (b) Clitellar glands; (c) Transverse section of ectal duct; (d) Sperm funnel and part of duct; (e) Lymphocytes; (f) Spermatheca.

Guaranidrilus cernosvitovi sp. nov.

Guaranidrilus fridericoides nom. nud. Černosvitov, 1937a : 282.

DESCRIPTION. Length (preserved specimens) 12-13 mm, width 0.4-0.5 mm. Segments 47-48 (6 specimens). Setae straight with weak ental hook, approximately equal, 50-60 µm. Cutaneous glands indistinct. Clitellum extending over XII- $\frac{1}{2}$ XIII with squarish glands arranged in transverse rows (Fig. 1b). Head pore at the tip of the prostomium. Three pairs of septal glands, all with ventral lobes and united dorsally. Brain incised posteriorly. Transition between oesophagus and intestine not sudden, represented by a slight enlargement at VII/VIII. A pair of more or less spherical glands attached to the oesophagus dorso-laterally in VI, 80-100 µm in diameter, highly vascularized (Fig. 1a). Paired, hollow, bilobed intestinal diverticula in VII, 230 µm in length, their point of attachment just in front of the oesophago-intestinal transition (Fig. 1a). Chlorogogen cells about the same size as the lymphocytes or a little smaller. Lymphocytes nucleated, finely granulated, 25-35 µm, mostly spindle-shaped, sometimes oval or circular

(Fig. 1e). Nephridia all with a large anteseptal portion about one-third the total length of the nephridium; efferent duct terminal, short. Origin of dorsal vessel at X/XI.

Sperm funnel large, 350 μm in length, width varying between 75 and 200 μm with a wide, much-lobed collar (Fig. 1d). Sperm duct long and coiled into a spiral. Seminal vesicle very large, occupying IX–XI. Penial bulb small. Spermatheca large with a thick-walled ectal duct (Fig. 1c) extending through V and VI and a large cylindrical ampulla, 150–230 μm in diameter, extending through VII and VIII (Fig. 1f). Ectal glands absent.

TYPE MATERIAL. Holotype: 1 microslide (unstained whole mount prepared by the author), British Museum (Natural History) Reg. No. 1949.3.1. Collected 12.vi.32; collector unknown. Paratypes: 3 microslides (whole mounts), 3 microslides (vertical longitudinal sections), 2 microslides (transverse sections), British Museum (Natural History) Reg. Nos 1949.3.1b–i. Spirit material (about 17 specimens).

TYPE LOCALITY. Loreto, near Santa Ana, Misiones, Argentina. Habitat unknown.

REMARKS. The species is well defined and readily distinguished by its large size and large sexual organs, i.e. sperm funnels, seminal vesicle and spermathecae. There appears to be little variation in segment number or in the form of the internal organs.

It is not evident why Černosvitov failed to describe so distinctive a species, especially as more material was available to him than for either *G. glandulosus* or *G. rarus*. Two of the microslides in his collection (longitudinal and transverse sections) are excellent and show most diagnostic characters clearly.

Guaranidrilus europeus sp. nov.

DESCRIPTION. Small species, length 3–6 mm, width 100–140 μm . Segments 23–29. Setae straight with weak ental hook, two per bundle throughout, approximately equal, about 20 μm (Fig. 2d). Setae absent in XII. Occasional single setae in the coelom. Cutaneous glands indistinct, elongated, 3–5 rows per segment (Fig. 2a). Clitellum extending over XII $\frac{1}{2}$ XIII with 20–33 rows of squarish glands (Fig. 2b). Head pore near the tip of the prostomium. Three pairs of septal glands, all united dorsally and with ventral lobes (Fig. 2h). Brain about twice as long as broad, the posterior margin deeply cleft (Fig. 2e). Sudden transition between oesophagus and intestine usually at VII/VIII but the position can vary according to the state of the intestinal diverticula. When these are expanded, the intestine may be constricted so that the swelling appears in IX. The two lateral intestinal diverticula communicate at VII/VIII and extend both forwards and backwards (Fig. 3a). They usually measure 150–160 μm and occupy VII and VIII but may extend anteriorly into VI and posteriorly into XI. They are hollow and highly contractile but do not pulsate; some variations in shape are shown in Fig. 3. Chlorogogen cells about the same size as the setae. Lymphocytes circular or oval, finely granular and nucleated, 10–20 μm (Fig. 2c). Nephridia similar throughout, the anteseptal portion large with coils on the canal, the efferent duct terminal (Fig. 2i). Dorsal vessel originating in XII or XIII, blood colourless.

One or two mature eggs present at a time. Sperm funnel pear-shaped, about 1 $\frac{1}{2}$ times longer than wide, length 40 μm (Fig. 2g). Sperm duct long and coiled. Seminal vesicle absent. Spermatheca free, its length 2–2 $\frac{1}{2}$ times the diameter of the worm. The thin-walled ectal duct has small scattered gland cells. It expands gradually into a terminal ampulla in VI. There is a slight expansion of the ectal duct near its orifice but no ectal glands (Fig. 2f).

The description is based entirely on live specimens. The worms were transparent when viewed microscopically and all characters could be readily observed. Thirty-two specimens were examined from two widely separated populations; intraspecific variation appears to be slight.

TYPE MATERIAL. Holotype: 1 microslide (whole mount) British Museum (Natural History) Reg. No. 1978.39.1. Collected by the author 21.x.77. Paratypes: 1 microslide (whole mount), British Museum (Natural History) Reg. No. 1978.39.2. 2 microslides (whole mounts), Museum

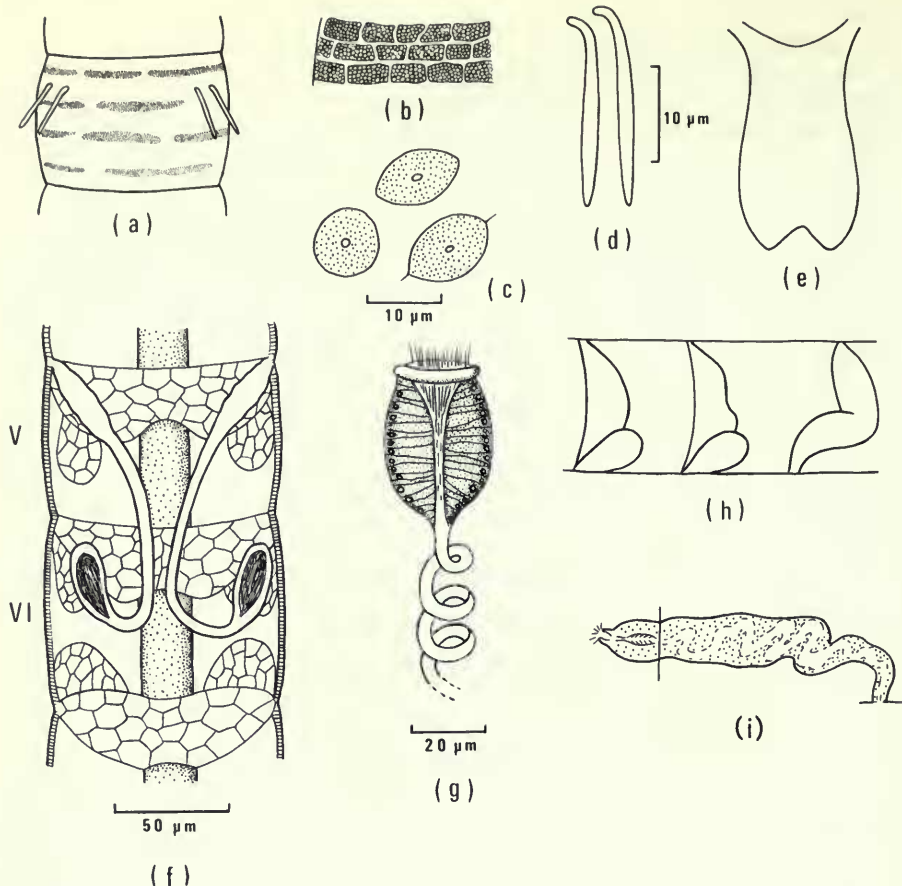


Fig. 2 *Guaranidrilus europeus* sp. nov.: (a) Preclitellar segment showing cutaneous glands; (b) Clitellar glands; (c) Lymphocytes; (d) Setae; (e) Brain; (f) Segments V-VI showing septal glands and spermathecae; (g) Sperm funnel and part of duct; (h) Septal glands, lateral view; (i) Nephridium.

National d'Histoire Naturelle, Paris, Reg. Nos AP 700-701. 7 microslides (whole mounts) and 5 specimens fixed in Bouin's in the author's collection. Collected by the author 21.x.77.

TYPE LOCALITY. Near Arcachon, S.W. France. Beside a small pond in a pine-wood clearing at the edge of the road from Le Corneau to Pilat. Wet sandy peat and peaty sand, pH 4.0-5.7.

OTHER MATERIAL EXAMINED. 9 specimens from Roncesvalles, Spanish Pyrenees, collected 31.vii.75. Marshy pasture, wet-very wet, pH 6.0-7.2. 1 Specimen from a pasture near Arcachon, S.W. France, collected 6.vii.75. Moist sandy loam, pH 5.9-6.1.

REMARKS. The diagnostic characters of the species are its small size and the absence of both oesophageal glands and seminal vesicle.

Since it is unlikely that so distinctive a species could have been overlooked in northern Europe where the Enchytraeidae are quite well known, this new species is presumably confined to the south where it may represent a sub-tropical element in the European fauna. The enchytraeid fauna of southern Europe has received little attention; the only well-studied regions are northern Italy and Romania where *Guaranidrilus* has not been found. Hence, the genus may be confined to south-west Europe being representative of a Lusitanian fauna. In south-west France, *G. europeus* is rare. In July-August 1975 and October 1977 collections were made at 37 localities

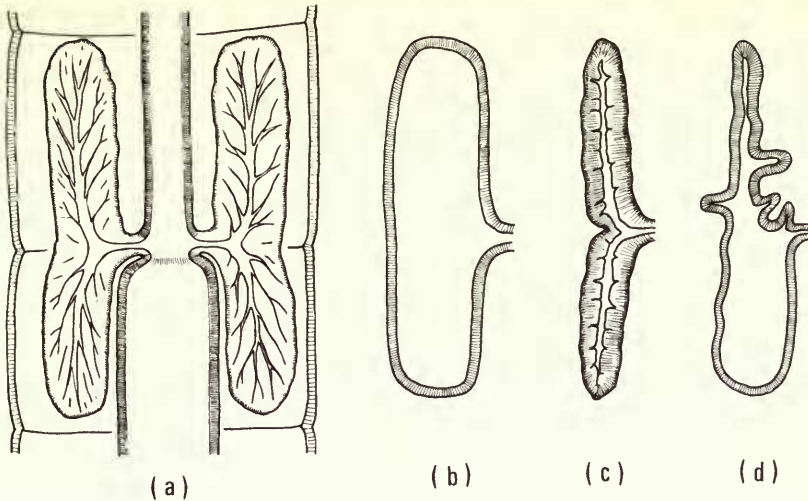


Fig. 3 *Guaranidrilus europeus* sp. nov.: (a) Intestinal divicula and oesophago-intestinal transition; (b)–(d) Various forms of the intestinal diverticula.

in the Landes, 12 in the Dordogne region and 11 in the Atlantic Pyrenees but *G. europeus* was found at only two sites. At the type locality the population was small and restricted to the edge of a small pond. At the other locality, only one specimen was found in spite of much searching. The population in the Spanish Pyrenees, discovered in July 1975, also appeared to be very localized. In October 1977, no specimens could be found at this locality. Generally, the enchytraeid fauna of Spain and Portugal is poorly known. Before the status of *G. europeus* can be established in Europe, it will be necessary to collect extensively in these regions and in the Mediterranean region of France.

Guaranidrilus columbianus (Michaelsen, 1913)

Henlea columbiana Michaelsen, 1913 : 211.

TYPE MATERIAL. Syntypes: 2 spirit specimens (1 mature, 1 immature), Zoologisches Museum, Hamburg, Reg. No. V 7739. Collected by O. Fuhrmann, date unknown.

TYPE LOCALITY. Medellin, Medellin Lake at Ufer, Colombia. Altitude 2000 m. Habitat unknown.

REMARKS. Michaelsen's description, although covering the principal features, is imprecise in places and is not illustrated, hence the species is not clearly defined. He referred it to the genus *Henlea* on the morphology of the oesophago-intestinal transition which he observed just behind the septum in X with the dorsal vessel also originating in this position and large, hollow 'peptonephridia' in VII–IX. The spermathecae were seen to communicate with the oesophagus, a characteristic feature of *Henlea*. However, Černosvitov (1937b) considered that many features such as setal number, brain, septal glands, clitellar glands and spirally coiled sperm duct, linked the species with *Guaranidrilus* and that the 'peptonephridia' in VII–IX were in fact similar to the intestinal diverticula of *G. glandulosus*. He also observed that in *Guaranidrilus* the spermathecal ampulla often adheres to the oesophagus making it difficult to trace the spermatheca over its entire length, he concluded that Michaelsen may have been mistaken in his interpretation of this organ. In support of this view it is worth noting that Michaelsen seems to have experienced difficulty in distinguishing both spermathecae and 'peptonephridia' because he states that in one serially sectioned specimen the 'peptonephridia' appeared to extend forward as a narrow tube into V, terminating close to the opening of the spermathecal duct. It seems more likely that the tube was actually the spermathecal duct and that the spermathecal ampulla was not developed, as, for example, in an unfertilized specimen.

A re-examination of Michaelsen's type material led to the conclusion that Černosvitov was correct in placing the species in *Guaranidrilus*. Although the attachment of the intestinal diverticula could not be clearly seen in either of the specimens, the organs are more similar in general appearance to those of other members of the genus than to those of the known species of *Henlea*. Unfortunately, the proximal regions of the spermathecae were not distinct in the single mature specimen so the uncertainty concerning the communication with the oesophagus remains. It was possible, however, to see the nephridia which Michaelsen did not describe fully. They are clearly of the *Guaranidrilus*-type with a large anteseptale consisting of nephrostome surrounded by coils of the canal and a terminal efferent duct, quite different from the *Henlea*-type in which the anteseptale consists of nephrostome only and the efferent duct originates in the anterior position just behind the septum.

From the information available, the distinguishing characters of *G. columbianus* are its size, the absence of oesophageal glands and seminal vesicle and the position of the intestinal diverticula and oesophago-intestinal transition. In both type specimens the intestinal transition is at VIII/IX, not at IX/X as stated by Michaelsen. However, the specimens are somewhat contracted and there may have been displacement of some organs. In the immature specimen, intestinal diverticula on both sides are confined to VII and VIII but in the mature specimen one of the sacs occupying VIII extends back into IX. There may therefore be variations in the size of the diverticula.

Guaranidrilus lamottei Omodeo, 1958

Guaranidrilus lamottei Omodeo, 1958 : 11, fig. 1.

TYPE MATERIAL. Not located. Collected 8-9.viii.51.

TYPE LOCALITY. Zougépo, Mount Nimba, Ivory Coast. Path in mountain grassland, 1360 m.

REMARKS. The description was based on immature specimens only and is thus incomplete. The author referred the species to *Guaranidrilus* with some hesitation noting that several features such as the position of the head pore at O/I and the ciliated inner surface of the intestinal diverticula are more characteristic of the *Henlea* group. There may be some doubt about the position of the head pore since the author admitted that it was barely perceptible. The bilobed diverticula at the oesophago-intestinal transition, the nephridia with terminal efferent ducts, the presence of free spermathecae and coiled sperm ducts are characteristic of *Guaranidrilus*.

G. lamottei possesses some unusual features not shown by other members of the genus, notably the absence of dorsal setae in all segments posterior to VIII and the length and point of attachment of the oesophageal glands. The almost straight posterior border of the brain also distinguishes it from other species. In view of these peculiarities and the immaturity of the specimens, the systematic position of the species must remain uncertain.

Guaranidrilus rarus Černosvitov, 1937

Guaranidrilus rarus Černosvitov, 1937b : 151, figs 10-15.

TYPE MATERIAL. Syntypes: 2 microslides (1 whole mount and 1 of horizontal longitudinal sections), British Museum (Natural History), Reg. Nos 1949.3.1.954-955. Collected 21.xii.31; collector unknown.

Černosvitov (1937b) noted that only two mature specimens were found. As the two specimens in the British Museum (Natural History) collection must therefore represent the entire material underlying the description, it is evident that Černosvitov did not deposit the specimens in the Museo Argentino as he stated.

TYPE LOCALITY. Loreto, near Santa Ana, Misiones, Argentina. Under the bark of an old tree.

REMARKS. Černosvitov distinguished *G. rarus* from *G. glandulosus* on the position of the intestinal dilatation in VII and not in VIII, the smaller size of the intestinal diverticula, the origin of the dorsal vessel at X/XI instead of at XII/XIII and the absence of cutaneous glands. The size of the intestinal diverticula cannot be considered significant in view of the contractile nature of

these organs while the position of the intestinal swelling may also be variable. A more reliable taxonomic character is the position of attachment of the intestinal diverticula – clearly seen in the longitudinal sections. This character, together with the point of origin of the dorsal vessel, could be sufficient to delineate this species but since observations were made on only two specimens, the consistency of these characters cannot be considered proven. The small size of the specimens may be diagnostic but it is possible that this is due to ecological factors such as low moisture content. The segment number falls within the range of *G. glandulosus* (Table 1) and both oesophageal glands and spermathecae are similar in the two species. In view of these similarities, the lack of reliable diagnostic characters and the paucity of material, the validity of the species must be considered doubtful.

Acknowledgments

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